

net revenue of 6,000*l.*, under the authority, it is true, of recent Acts of Parliament, is devoted to livings and churches; a considerable deviation, as the Commissioners observe, from the intention expressed in the will of the benefactor. The returns of the value of the Professorships are equally significant, for the five Divinity Chairs are each endowed with 1,500*l.* and a house, whereas the average of the remaining Professorships cannot be more than 500*l.* without a residence. It may here be incidentally mentioned that the collective income of the Oxford Professors from all sources amounts to 25,000*l.*, of which only 450*l.* comes from fees, and more than half of this latter sum from the fees of the four Science Professors.

Concerning the number of Fellowships confined to those who have taken or who have promised to take orders, this Report is entirely silent, on the same principle apparently as it omits to state what proportion of the College endowments is appropriated to the encouragement of Physical Science. For information on this latter topic, recourse may be had to the Report of another Royal Commission lately published, and the University Calendars yield some evidence on the former point. As to Oxford, it has been calculated that with the exception of Merton, where for the future all Fellowships, as well as the Headship, will be entirely open, nearly half the Fellowships are what is commonly called clerical, and all the remaining Headships are confined to clergymen. The proportion in the different Colleges is very irregular, but the reader will hardly be surprised to learn that, in accordance with what has been intimated above, at the four wealthiest Colleges the proportion is as high as two clerical fellows to one lay.

All these facts, and there are more of the same character, seem to point one way: that when the reconstruction of the Universities becomes a matter of public and not special interest, and when the uses to which their endowments are put shall be fundamentally reconsidered in the light of modern experience, one of the first questions which the nation will have to decide for itself will be whether so large a portion of academical property shall in the future be limited to purposes which certainly are not educational, and nowhere else than in England would ever be thought to be academical. That the Colleges themselves cannot be permitted to settle these great questions at their own sweet will is abundantly made clear by the facts recorded in this Report. It may be granted that the reformed statutes of a few of the Oxford Colleges, which are appended at the end of this volume, promise to abolish certain of the more prominent evils in their constitution, which evils indeed nowhere find any active defenders; but in none of these schemes is adequate importance attached to the duty of encouraging original research, the one part of its academical functions which Oxford neither performs nor regrets to have left unperformed. Moreover, the well-intentioned activity of some three or four of the less wealthy Colleges affords no guarantee that the greater institutions will not continue in their wasteful courses, and permit fresh vested interests to be acquired daily. Perhaps public opinion is not yet fully ripe, and perhaps those who have interested themselves in these subjects are not yet sufficiently unanimous; but for the future, at any

rate, no excuses of this kind ought to be tolerated. The Commission on Scientific Instruction and the Advancement of Science has thrown into shape a scheme of reform which, though primarily adapted to the case of original research in the physical sciences, is capable of being extended to similar branches of genuine study, and to the outline of that scheme many prominent men, statesmen and others, have given in their adhesion. This Commission has now in its Report given us all the materials requisite for discovering where the necessary funds shall come from; and from henceforth it will be only due to laziness, or to individual perversity, if a definite scheme of University Re-organisation, conceived in the interests of unencumbered investigation and mature study, is not soon presented for the acceptance of the public.

SEDLEY TAYLOR'S "SOUND"

Sound and Music: a Non-mathematical Treatise. By Sedley Taylor, M.A. (London: Macmillan and Co.)

FINDING from the title-page and preface that this work, though non-mathematical, undertakes to give an account of the acoustical discoveries of Helmholtz, we acknowledge having felt some misgivings when we commenced the perusal of it. We will presently inform our readers whether we found our fears justified or not by the book itself; but we must first state why we felt them.

The recent reasonable and even necessary outcry for popular scientific education in this country has led to the publication of a perfect shoal of elementary treatises. Everyone who has a smattering of knowledge or who has access to a consulting library considers himself thereby fitted to write a treatise. For one such that is written by a man thoroughly competent as far as knowledge and experience can qualify him, we have half a dozen written by popular lecturers, or rather showmen, in whose eyes sensational experiments sensationally described form the really attractive portion of science! Besides these, we have a dozen others—some the work of those fluent writers who can master a new subject in a week, complete an octavo treatise on it by the end of the month, see it through the press, and proceed immediately to repeat the process on something newer still; the others, the original work of uninstructed but aspiring men, who have learnt too little to be aware either of what science is or of their own utter ignorance of it. This is no fancy sketch, but, as all competent to judge will allow, an exceedingly unpleasant reality. In some subjects, no doubt, competent men have the field (as yet) left almost to themselves. It is only now and then that an ignoramus ventures to produce a treatise on Hyperdeterminants, Vortex Motion, or Specific Inductive Capacity. Yet, if books on such subjects could command a host of eager and ignorant purchasers, there would soon be a supply from quarters hitherto undreamt of. But anyone and everyone can write on such simple matters as heat, light, electricity, or (more to our present purpose) sound and music. "Bother Helmholtz, and Clerk-Maxwell, and Thomson," cries a public athirst for sensation, and whose palate is already dead to all but the most potent spices; "we want excitement, knowledge too if it comes painlessly, but excitement;" which (viz. the sensation and the excitement) are precisely what that same public will

not get from Mr. Taylor's work. Not once, in the whole course of his 219 pages, has he condescended to cater for the mere amusement of his reader. We hope, but almost against hope, that this will not interfere with the sale of his book.

The book, with the exception of a few slight blemishes, to some of which we will presently advert, is a very good one indeed: lucid, comprehensive, and accurate. Many of the more difficult ideas introduced are illustrated very happily by analogy; and, so far as the first half of the volume is concerned, there is nothing which should present a difficulty to any reader of average intelligence. It is necessarily otherwise with the second half, which treats mainly of music, for this is a subject which mere intelligence, however acute, will not enable a man to master. One may as well discourse of colours to the congenitally blind, as of music to a man devoid of "ear." It has often struck us as one of the most remarkable of phenomena in the physical world, that while we ourselves were only greatly annoyed by the discordant grinding of some street-organ miscreant, one friend beside us has been almost in a state of frenzy, while another, on the contrary, listened with the most stolid indifference. [We leave it to the psychologists to consider whether the mind itself may not, in certain individuals, have similar excess or defect in some particular quality, and if so, to explain by it the existence alike of sceptics and of fanatics.] Considering that this extraordinary difference is often found to exist between individuals nearly related, and in all other particulars closely resembling one another, it is not to be wondered at that even among those who possess in a special manner an ear for music, individuals should be found to differ widely from one another on many of the less important points. In such a case who is to decide? *Ceteris paribus*, we should be inclined to side with the mathematician, who has, as it were, an extra sense in addition to those possessed by his antagonist. Wherever, then, we find that Mr. Taylor's view is not exactly in accordance with that of Helmholtz (though the discrepancies, so far as we venture to think we understand them, are few, and, with one exception, of apparently small importance), we are inclined to take the side of Helmholtz. But, we repeat, this is not to be considered as a demerit of Mr. Taylor, for the main point of variance (if we be correct in supposing it to exist) seems to be an æsthetic one, upon which only a comparatively small number of persons (and these not only exceptionally gifted, but also highly trained) are competent to form an opinion. We outsiders may judge of the value of such opinions by comparing the verdicts of different art critics on the same picture; though in the case of sound, where the physical processes (in the external ear at least) are thoroughly known to the mathematician, he ought to have a decided advantage over those who have not his physical insight. The following passage (§ 75), seems particularly happy:—

"That *two sounds should produce absolute silence* seems, at first sight, as absurd as that *two loaves should be equivalent to no bread*. This is, however, only because we are accustomed to think of sound as something with an external objective existence; not as consisting merely in a state of motion of certain air-particles, and therefore liable, on the application of an opposite system of equal forces, to be absolutely annihilated."

There is, however, considerable objection to be taken to the word *forces*. Had Mr. Taylor said *motions*, or still better *disturbances*, the passage would have been not only clearer but more correct.

A closely-connected mistake occurs, in two different forms, in §§ 22, 50. In the former, the word *force* is used in place of *energy*; in the latter, *energy* is used where *force* is obviously the correct word. But here, though in all probability unconsciously, Mr. Taylor is only following the metaphysicians and other quasi-scientific men, who give what they call a "broad basis" to the meaning of a word by using it now in one sense and anon in quite a different one.

Another curious statement, occurring in § 8 and repeated in § 37, seems to show that Mr. Taylor's clock has a half-second pendulum, for he speaks of a *complete* oscillation (from side to side and back again) as taking place in one second!

The inherent defect of all non-mathematical treatment of a subject undoubtedly mathematical shows itself in the elaborateness of Mr. Taylor's explanation of wave-motion. We are quite sure that a very slight amount of the most elementary geometry, properly introduced, would have enabled him to condense the whole of this part of his work into one-third of its present bulk or even less, and this with a decided increase of simplicity and intelligibility to the ordinary reader.

We object entirely to the word *strictly* in the foot-note to § 5, for, instead of being *not strictly accurate*, the statement referred to is not even approximately accurate. In the same section there is an illustration of wave propagation by the alternate kneeling and standing of the individuals of a line of men, where the reader is likely to be much puzzled by the printing of "two, six, and nine," instead of "twenty, sixty, and ninety." This, however, may be called hypercriticism, so we proceed to point out that in § 23 there is a genuine blunder. Mr. Taylor says that in the diminution of loudness and dying away of the sound of a pianoforte wire once struck, "the effect produced is the same as if our harmonium had, while sounding out its note, been carried gradually further and further away from us," forgetting altogether what, indeed, we do not find in his book, the lowering of pitch which accompanies diminution of intensity when the source of sound moves away from the observer.

In § 54 the word *submission* (subdivision?) produces a curious effect, due probably to the printer.

We conclude by repeating that the work is a very good one, worthy of the subject; and that we are glad to see that (in default of an English translation of the "Tonempfindungen") the beautiful discoveries of Helmholtz have found in this country an able and congenial expositor. Had we thought less of the work we should not have been driven to criticism of mere isolated words or phrases which easily escape detection by an author himself. Yet, after all, we must conclude with an expression of amazement that a man who shows himself to have so thorough an appreciation of harmony as does Mr. Taylor, should tolerate for a moment in his pages a foreign word such as *timbre*, when we have an excellent and generally received English equivalent for it; or employ for a concord such a hideously inappropriate word as the English *clang*.